

Attorney Docket No.: 6500-1801.2  
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Title: A Cable Separator Spline  
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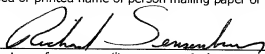
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## A CABLE SEPARATOR SPLINE

### FIELD of the INVENTION

5           The present invention relates to a separator filler or spline. More particularly the present invention relates to the separator filler or spline having four pockets with each pocket having a cross-sectional area that is less than the envelope area of a pair of cables adapted to be placed in each pocket.

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### BACKGROUND of the INVENTION

          The most popular separator fillers or splines are generally based on a circular cross-section wherein each pocket generally has a cross-sectional area that is greater than the cross-sectional envelope area of the twisted pair cable that is to be placed in the pocket. This type of spline generally has less flexibility and undesirable to skew degradation.

### 20       SUMMARY of the INVENTION

          The oval envelope provided by my spline has an acceptable NEXT performance and good flexibility. Therefore, it is an object of the present invention to provide a cable separator filler or spline having a plurality and preferably four opened pockets for separating a plurality of cable pairs, preferably one cable pair for each pocket. Preferably when there are an even number of pockets, the pockets are diametrically opposite each other. When there are four pockets, the first and second pockets are diametrically opposite each other and third and fourth pockets are diametrically opposite each other. In a cross-sectional plane of the spline the diametric distance between the ends of the first and second pockets is greater than the diametric

distance of the ends of the group of the third and fourth pockets to provide an oval envelope for the spline. All of the pockets have a cross-sectional area that is less than the envelope cross-sectional area of the cable pair that is to be placed in the respective pockets. The longitudinal axis of each of the pockets are all substantially parallel to each other.

A cable manufactured using the spline of my invention generally uses an oval envelope spline having four pockets and has a twisted pair cable in each pocket. The long lay twisted pair cables are both preferably in the pockets on the major axis of the oval envelope. The short lay twisted pair cables are both in the pockets on the minor axis of the oval envelope. In this embodiment the core components are comprised of the elongated separator spline and the four twisted pair cables. The core can of course be shielded and jacketed, just jacketed or any other desired cable construction that would benefit from the use of my elongated separator spline.

With my elongated separator spline long and short lay twisted pairs can be ideally placed for maximum electrical advantages. Short lay pairs, which have the best flexibility can be placed across the minor axis of the separator spline. Short lays typically have improved NEXT and the close proximity to one another does little to worsen NEXT. The long lay pairs can be placed across the major axis where bending strain is minimized. This overall cable design will bend across the minor axis based on the fact that the "column" will collapse across its minimum integral bending moment axis. The use of my elongated separator spline also improves skew over a similar round design because two unique cabling lay factors are in practice when the twisted pairs are cabled ( minor and major axis). This helps compensate for the pair lengths between the long and short lay pairs equalizing the final conductor lengths which also tends to improve attenuation delta from the minimum lay pair to the maximum lay pair. My spline may be "metalized", or coated with any form of metallic material that will

preserve its exterior shape, and substantially improve NEXT while still enhancing the attenuation delta and skew of pairs.

Generally alien NEXT is minimized since the cables "oval" will provide air spacing between parallel cables of any other type. Also  
5 there are economies in my spline over the generally used cylindrical splines in that less filler material generally is used in my elongated separator spline than in a round design for equal performance.

The present invention and the advantages thereof will become more apparent upon consideration of the following detailed description  
10 when taken in conjunction with the accompanying drawings

## **BRIEF DESCRIPTION OF THE DRAWINGS**

FIGURE 1 is a perspective view of the elongated separator  
15 spline of my invention.

FIGURE 2 is a cross-sectional view taken along lines 2-2 of  
FIGURE 1.

FIGURE 3 is the same as FIGURE 2 except having a shaded  
portion to define a cross-sectional area.

FIGURE 4 is a cross-section of a twisted pair cable to be used  
20 with the spline of FIGURE 1.

FIGURE 5 is perspective view of a cable utilizing my elongated  
separator spline.

FIGURE 6 is a cross-section view taken along lines 6-6 of  
25 FIGURE 5.

FIGURE 7 is a perspective view of another cable utilizing my  
elongated separator spline.

FIGURE 8 is a perspective view of still another cable utilizing  
my elongated separator spline.

FIGURE 9 is a perspective view of a further cable utilizing my  
30 elongated separator spline.

## DETAILED DESCRIPTION

The following description taken in conjunction with the drawings will further explain the inventive features of my elongated separator spline and cables utilizing my elongated separator spline.

Referring to FIGURES 1 and 2, my elongated separator spline 20 has along its cross-sectional plane a major axis 21 and a minor axis 22. In the preferred embodiment, the minor axis 22 is perpendicular to the major axis 21. The preferred elongated separator spline 20 is shown with four cable pockets 23, 24, 26, and 27. Other oval configurations could have more all less pockets. The pockets 23 and 24 are on the major axis 21 and pockets 27 and 26 are on the minor axis 22. In a preferred embodiment, pockets 23 and 24 have the same cross-sectional area as each other and pockets 26 and 27 have the same cross-sectional area as each other. If desired, they can all have the same cross-sectional area. The cross-sectional area of the pockets as shown in FIGURE 3. These are indicated by the shaded areas 28 and 29.

FIGURE 4 illustrates a cross-section of a twisted pair cable 30 having a pair of conductors 35 with appropriate insulation 35(a). The cable 30 has a circular envelope 31. The cross-sectional area of the twisted pair circular envelope 31 is greater than the cross-sectional area of any of the pockets.

Each of the pockets 23 and 24 have a depth 32 and each of the pockets 26 and 27 have a depth 33. The depths 32 and 33 of the pockets is less than the diameter 34 of the twisted pair envelope 31. The cross-sectional depth 32 of the pockets 23 and 24 is less than the cross-sectional depth 33 of the pockets 26 and 27. In a preferred embodiment, each of the cross-sectional areas 28 and 29 is 25% to 75 % of the cross-sectional area of the envelope 31. The preferred elongated separator spline 20 has four longitudinally extending pockets 23, 24, 26 and 27 of two different sizes. However, if it is desired, the

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sizes of the pocket can all be different depending upon the size of the cables that are to be placed in the pockets. The size of the pockets will scale up or down based on the size of the cable, i.e., 30 (Fig. 4) to be placed in the pocket. If desired, the pockets may even have a depth which is greater than the diameter of the cable pair envelope.

The present embodiment's major axis 21, when measured from the inside bases of the pockets 23 and 24, has a length 36 of 0.050 in. to about 0.100 in. The minor axis, when measured from the inside bases of the pockets 26 and 27, has a length 37 of about 0.010 in. to about 0.030 in. The preferred material for the elongated separator spline is any suitable solid or foamed polymer or copolymer depending on the needs of the user for crush resistance, breaking strength, gel fillings, safety, and the need for flame and smoke resistance. In many applications the material will be a polyethylene.

Referring to FIGURES 5 and 6, there is shown a cable 40, having as its core 44 my elongated separator spline 20 with major axis pockets 23 and 24 each containing a twisted pair cable 42 having a long lay of about 0.5 in. to about 1.5 in. and with minor axis pockets 26 and 27 each containing a twisted pair cable 41 having a short lay of about 0.25 in. to about 0.75 in. The core which contains the elongated separator spline 20 and the cables 41 and 42 in the pockets as shown in FIGURES 5 and 6, is surrounded by a jacket 43 which was extruded thereover. The jacket 43 can be any suitable jacket material normally utilized such as anyone of the following which also may be foamed on non-foamed i.e. polyvinyl chloride, fluorinated polymers, polyethylene, the flame retardant compositions, etc. The twisted pair cables 41 and 42 are the same construction as the twisted pair cable 30.

Referring to FIGURE 7 there is shown a cable 50 having the same construction as the cable 40 except it has shield 51 wrapped around the core 44. The shield 51 may be any suitable shield such as an aluminum tape, BELDFOIL, DUOFOIL, or any suitable metal tape.

The shield 51 is generally laterally wrapped around the core 44 and then the jacket 43 is extruded around the shield. Although the shield is shown as a lateral wrapped tape, it can be a helically wound tape. A drain wire (not shown) can be inserted into the cable 50 if desired.

5 Referring to FIGURE 8, there is shown a cable 60 using a drain wire 61. The cable 60 has the same construction as the cable 50 except in this embodiment of the drain wire 61 is helically wrapped around the lateral shield 51 for the dual purpose of being a drain wire and to hold the lateral shield 51 in place. The jacket 43 is then  
10 extruded over the shield 51 and drain wire 61.

Referring to FIGURE 9, there is shown still another cable 70 having the same construction as the cable 50 except it uses a drain wire 71 having a gentle wrap around the lateral shield 51. The jacket 43 is then extruded over the shield 51 and drain wire 71.

15 The drain wires 61 and 71 are generally made with tinned copper, tinned aluminum, etc.

The size of the twisted pair cables 41 and 42 are generally about 24AWG. to about 22AWG.

The conductors 35 for the twisted pair cables are generally  
20 copper, tinned copper, or an appropriate bronze and these are generally insulated with a foamed on non-foamed insulation 35(a) of polyethylene, polypropylene, fluorinated ethylene propylene, tetrafluoroethylene, polyvinyl chloride, etc.

Although I have described my elongated spline as having four  
25 pockets, the spline may have more or less pockets.

It will, of course, be appreciated that the embodiments which have just been described have been given by way of illustration, and the invention is not limited to the precise embodiments described herein. Various changes and modifications may be effected by one  
30 skilled in the art at without departing from the scope or spirit of the invention as defined in the appended claims.